

Evaluating the Salt and Boron Tolerance of English Walnut Rootstock



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Introduction

In areas of California with a high incidence of Walnut Blackline disease, walnut orchards are increasingly being planted on English walnut (*Juglans regia*) rootstocks that are tolerant to the virus. There is limited documentation on the salt or boron tolerance of this rootstock. This work was done to quantify the response of English walnut rootstocks to high boron (B), chloride (Cl) and sodium (Na) and to compare this to the more common rootstocks, Northern California Black (*J.hindsii*) and Paradox (*J. hindsii* x *J. regia*).

Methods

Experimental Design:

- Randomized complete block
- 20 replicates

Each replicate included a single Chandler tree on:

- No. Ca. Black rootstock
- English rootstock
- Paradox rootstock



Data Collection:



July leaf samples were collected over a 2 year period.



Soil samples were collected the first year



Bark cores were collected from both rootstock and scion the first year

Results

Leaf Analysis

- Salt accumulation in leaves was greatest in trees on English rootstock, least in those on No. Ca. Black, and intermediate in those on the Paradox hybrid.
- Visual symptoms of leaf toxicity corresponded closely to tissue analysis.
- Foliar toxicity was readily reversed the next year by changing to an irrigation water source with a lower salt content.

Year 1

| | B (mg/kg) | Cl (%) | Na (mg/kg) |
|--------------|-----------|--------|------------|
| Black | 479.9 b | 0.68 c | 55.7 b |
| English | 704.3 a | 2.06 a | 124.9 a |
| Paradox | 667.3 a | 1.82 b | 87.2 b |
| Excess Level | >300 | >.30 | >100 |

Means followed by the same letter within a column are not significantly different at the 5% level by Fisher's LSD

Year 2

| | B (mg/kg) | Cl (%) |
|--------------|-----------|--------|
| Black | 200.1 c | 0.24 c |
| English | 367.6 a | 0.68 a |
| Paradox | 325.8 b | 0.54 b |
| Excess Level | 300 | .30 |

Means followed by the same letter within a column are not significantly different at the 5% level by Fisher's LSD

Soil Analysis

- A slight excess of Boron had accumulated in the top foot of soil indicating that the source of B was from the surface applied irrigation water.
- Other salts increased with depth due to leaching efforts and were below damaging levels at all other depths except for Cl at the deepest depth.

| Depth | EC (dS/m) | Cl (meq/L) | B (mg/L) |
|--------------|-----------|------------|----------|
| 1' | 0.91 a | 3.19 a | 0.50 a |
| 2' | 0.90 a | 3.53 a | 0.42 b |
| 3' | 1.06 b | 4.47 b | 0.38 bc |
| 4' | 1.24 c | 5.04 c | 0.35 c |
| Excess Level | 1.5-4.8 | 5.0-10.0 | 0.5-3.0 |
| moderate | > 4.8 | >10.0 | > 3.0 |
| severe | > 4.8 | >10.0 | > 3.0 |

Means followed by the same letter within a column are not significantly different at the 5% level by Fisher's LSD

Foliar symptoms



Chandler on Northern California Black (*J. hindsii*) rootstock



Chandler on English (*J. regia*) rootstock



Chandler on Paradox (*J. hindsii* x *J. regia*) rootstock

Bark Cores

- There was no significant difference in the Boron (B) uptake between rootstocks.
- All rootstocks accumulated more B than their respective scions indicating that B transport may be limited by the graft union or controlled by the rootstock.
- English rooted scions accumulated significantly more B than those on other rootstocks indicating that rootstocks with *J. hindsii* parentage may be better able to reduce B transport into the scion.

| Year 1 | Boron (mg/kg) | |
|---------|---------------|--------|
| | Rootstock | Scion |
| Black | 28.0 a | 13.3 b |
| English | 27.9 a | 19.1 a |
| Paradox | 23.9 a | 15.3 b |

Means followed by the same letter within a column are not significantly different at the 5% level by Fisher's LSD